AECOM

Environment

Submitted to:
Sumitomo Metal Mining Pogo LLC
Delta Junction, Alaska

Submitted by:
AECOM
Fort Collins, Colorado
60284905.1600
August 2013

Sumitomo Metal Mining Pogo LLC
Unit 412 CISWI Test Plan

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Sumitomo Metal Mining Pogo LLC Unit 412 CISWI Test Plan

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1.0 Introduction

Sumitomo Metal Mining Pogo LLC (Pogo) mine facility is located near Delta Junction, Alaska 99737. The Pogo facility operates under the Alaska Department of Environmental Conservation (ADEC), Air Quality Control Minor Permit Number AQ0406MSS06, issued on May 12, 2011. In the operation of the facility, Pogo employs Unit 412 which is an incinerator used to burn facility non-hazardous waste. This test program is designed to evaluate Unit 412 pollutant emission rates with regard to the Commercial and Industrial Solid Waste Incinerator (CISWI) rule emission limits. The test program will serve as an initial performance test to demonstrate compliance with the CISWI rule emission standards, and to determine what, if any, pollution controls may be needed to achieve compliance. The field measurements of Unit 412 include the following:

- Particulate (PM);
- Nitrogen Oxides (NO_x);
- Dioxins and Furans (D/F);
- Cadmium (Cd);
- Mercury (Hg);
- Sulfur Dioxide (SO_2);
- Carbon Monoxide (CO);
- Hydrochloric Acid (HCl);
- Lead (Pb); and
- Fugitive Ash (Visible Emissions).

The measurements and analytical procedures to be followed for this test project are accepted United States Environmental Protection Agency (USEPA) Reference Method (RM) procedures and defined in the Code of Federal Regulations, Title 40, Part 60 (40 CFR 60), Appendix A. The results of all measurements will be provided in the same engineering units as the applicable emissions standards and will be directly compared to the CISWI rule emission standards.

Pogo has retained AECOM, Technical Services, Inc. (AECOM) to perform the required emissions measurements. AECOM is located at 1601 Prospect Parkway, Fort Collins, Colorado 80525-9769. Mr. John Rosburg, AECOM Emissions Measurements Manager, is the Project Manager for this test program. Mr. Rosburg may be reached by telephone at (970) 219-4904 or by e-mail at john.rosburg@aecom.com. Ms. Sally McLeod Pogo's Environmental Manager will be responsible for the coordination of the test program and collection of process data. Ms. McLeod may be reached by telephone at (907) 895-2879, by cell phone at (907) 978-3774, or by e-mail at Sally.Mcleod@smmpogo.com.

The following test plan is organized as follows: the testing approach is provided in Chapter 2.0; a description of the process is provided in Chapter 3.0; source test methodology, calculations, and nomenclature are presented in Chapter 4.0; a concise description of the quality assurance/quality control (QA/QC) procedures to be implemented is provided in Chapter 5.0; copies of the field data sheets to be used are provided in **Appendix A**; and copies of the source test methods are provided in **Appendix B**.

2.0 Test Approach

This test plan and protocol outlines specific methods and procedures for quantifying average PM, SO_2, NO_x, CO, D/F, HCl, Cd, Pb, Hg and visible emissions results from Unit 412. All measurements and procedures are accepted United States Environmental Protection Agency (USEPA) RM procedures and are defined in the Code of Federal Regulations, Title 40, Part 60 (40 CFR 60), Appendix A. **Table 2-1** provides the test matrix for the source to be tested and includes the test parameter, methods to be followed, number of sample runs and run duration. The test matrix shown in **Table 2-1** is based on the performance test requirements in the CISWI rule for small remote incinerators (see 40 CFR 60 Subpart CCCC, Table 8) The results of the field measurements results will be directly compared to the CISWI rule emission standards to evaluate compliance status and determine if pollution control is necessary.

Table 2-1 Unit 412 Test Matrix
Sumitomo Metal Mining Pogo LLC

Source ID	Test Type	Test Parameter	Method	Number of Runs	Minimum Sample Volume	Minimum Run Duration
Incinerator	Performance Test	Sample Points	RM 1	1	NA	NA
		Velocity	RM 2	3	NA	60 min
		Molecular Weight (O_2 & CO_2)	RM 3A	3	NA	NA
		Moisture	RM 4	3	21 dscf/run	60 min
		Particulate	RM 5	3	1 dscm/run	60 min
		Sulfur Dioxide	RM 6C	3	NA	60 min
		Nitrogen Oxides	RM 7E	3	NA	60 min
		Carbon Monoxide	RM 10	3	NA	60 min
		Dioxin/Furan	RM 23	3	1 dscm/run	120 min
		Hydrochloric Acid	RM 26A	3	1 dscm/run	60 min
		Metals (Cd, Pb, Hg)	RM 29	3	2 dscm/run	120 min
		Visible Emissions	RM 22	3	NA	60 min

Pogo must submit the test plan to the ADEC in accordance with the timeline specified in ADEC, Air Quality Control Minor Permit NumberAQ0406MSS06, Condition 26. Condition 26 states that before conducting any source test, the Permittee shall submit a plan to the Department. The plan must include the methods and procedures to be used for sampling, testing and quality assurance and must specify how the source will operate during the test and how the Permittee will document that operation. The Permittee shall submit a complete plan within 60 days after receiving a request under Condition 24 and at least 30 days before the scheduled date of any test unless the Department agrees in writing to some other time period. Condition 27 states that at least 10 days before conducting a source test, the Permittee shall give the ADEC written notice of the date and the time the source test will begin.

This test plan includes a description of the test methods, duration of sample runs, test locations, and source operations during testing. No deviations from the selected methodologies are anticipated.

2.1 Schedule

Per Conditions 26 and 27 of the permit, Pogo requests that this submittal serve as our notifications “to the ADEC. Pogo previously submitted a similar Test Plan to ADEC. If an unforeseen issue requires the test dates to be altered, ADEC will be notified as soon as practicable to discuss alternatives.

AECOM has scheduled the field program to be conducted during the week of September 30, 2013. On Day 1 (Monday, September 30) of the field effort, AECOM will travel to the Pogo Mine facility. On Day 2 (Tuesday, October 1) AECOM will prepare the measurements equipment for testing. Day 3 (Wednesday, October 2) will entail the performance of one combined PM and HCl sample run, one metals (Cd, Pb, Hg) sample run, one D/F sample run, one combined NO_x, SO_2, CO, O_2 and CO_2 sample run and one visible emissions sample run. The test schedule for Day 3 will be repeated on Day 4 (Thursday, October 3) and Day 5 (Friday, October 4). Day 6 will allow for sample runs to be performed if the schedule is not maintained. Demobilization of the equipment and field personnel will be performed on Day 6.

It is anticipated that the laboratory will take up to 30 days to complete the analysis and prepare its reports. Upon receipt of the laboratory reports, AECOM will finalize the data reduction of the measurements program and prepare the test report. The final report will be published and provided to the ADEC and USEPA no later than 60 calendar days from the completion of the field program.

2.2 Equipment Preparation

All equipment will be prepared and calibrated in accordance with USEPA's Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III; Stationary Source Specific Methods, 40 CFR 60, Appendix A; and AECOM's general QA/QC policy described in Chapter 5.0 of this protocol. These procedures meet or exceed all USEPA requirements and guidelines for equipment maintenance and calibration. All equipment will be in proper working order prior to mobilization to the facility.

2.3 Field Measurements

The Unit 412 incinerator test program will be performed under approved USEPA methods. The methods selected and listed in Table 2-1 above are applicable for the determination of the pollutant parameters required by the CISWI Rule. The PM/HCl, metals (Cd, Pb, Hg) and D/F samples will be withdrawn isokinetically from the source and collected on the front-half and condensate portions of the sample train. The sample volume collected during each run are specific to the pollutant parameter and dictated by the CISWI Rule. A total of three, with a minimum sample run time of one hour, sample runs will be performed for combined PM/HCl. A total of three, with a minimum sample run time of two hours, sample runs will be performed for metals (Cd, Pb, Hg). A total of three, with a minimum sample run time of two hours, sample runs will be performed for D/F.

Analysis of June 2013 test results confirms that the sample volumes listed in Table 2-1 will be sufficient to yield results that are greater than the minimum detection limits (MDL) of the associated methods. The quantities of target analytes measured in the prior RM29 and RM26A runs were several orders of magnitude greater than the MDL. In the RM23 run, 12 of 17 target D/F compounds were detected above the MDL; the sum of all non-detected MDL was less than one percent of the detected values, while the test results indicate that D/F emissions were at least 3 orders of magnitude below the standards on both a total mass basis and a toxic equivalency (TEQ) basis.

The gaseous pollutant (SO_2, NO_x, CO) and diluents (O_2 and CO_2) parameters will be measured with a continuous emission monitor system (CEMS). A minimum of three, one hour, sample runs will be performed. The response of the instruments in the CEMS will be digitally recorded, at one minute intervals, using Campbell Data Acquisition System (DAS). The CEMS will be calibrated with certified Protocol 1 calibration gas standards.

2.4 Audit Sample

Pogo has made arrangements to include RM 26A (HCl) and RM 29 (Cd, Pb, and Hg) Audit Samples as required by the NELAC Institute's (NI) Stationary Source Audit Sample (SSAS) Program which was approved by the USEPA on April 30, 2013 and requires audit samples for compliance demonstrations which began June 16, 2013. At this time audit samples are not available for D/F.

AECOM is responsible for obtaining the required audit samples. AECOM has sub-contacted Sigma-Aldridge RTC, an accredited audit sample provider, to prepare and deliver the required audit samples. On August 28, 2013, RTC contacted ADEC to gain approval of the expected range of the audit samples. Upon receiving approval from ADEC, RTC will ship the audit samples to Pogo to arrive before the end of the test program scheduled to begin on October 2, 2013. When the audit samples arrive on-site, AECOM will maintain chain of custody and make them available to ADEC and/or USEPA. At the conclusion of the test program, AECOM will deliver the audit samples to TestAmerica Sacramento along with the performance test samples. TestAmerica will analyze the audit samples at the same time, using the same equipment and personnel used to analyze the performance test samples and will provide the audit sample concentration results to RTC. RTC will compare the audit sample concentration to the actual concentration and report the results to ADEC, Pogo and TestAmerica.

2.5 Final Test Report

The Final Report will contain the following sections at a minimum:

- Executive Summary
- Introduction
- Summary of Results
- Source Description and Operation
- Sampling Methodology
- QA/QC Procedures
- Appendices

The Appendices will contain equipment calibration, field data sheets, calculations, and any other pertinent data such as process information. The final report will be published and provided to the ADEC and USEPA no later than 60 calendar days from the completion of the field program.

3.0 Process Description and Operation

3.1 Process Description

Unit 412 is an ACS, Inc., Model CA 400, non-hazardous waste incinerator. The unit is fired by propane. The capacities of the unit are as follows:

- Rated Capacity of 240 Lb/hr - Type '0' Waste;
- Rated Capacity of 400 Lb/hr - Type '1' Waste;
- Rated Capacity of 480 Lb/hr - Type '2' Municipal Solid Waste;
- Rated Capacity of 240 Lb/hr - Type '3' Waste.

3.2 Process Operation

The emission measurements of Unit 412 will be conducted under normal and representative process operations at the maximum achievable waste burning rate at the time of testing. For all measurements associated with Unit 412, all pertinent process and control device operations data will be monitored and recorded. The following parameters will be monitored and recorded during each sample run;

- Weight of each batch loaded into the incinerator;
- Weight of each type of waste comprising each batch loaded;
- Time interval between batches loaded;
- Primary oven temperature at 5- to 6-minute intervals;
- Secondary oven temperature at 5- to 6-minute intervals;
- Primary oven burn time following loading of final batch; and
- Secondary burn time following completion of the primary burn cycle.

Process operations data for the time periods during which testing is conducted will be provided in final test report.

4.0 Methodology

The testing program will be performed according to the following accepted and approved USEPA RMs as contained in the USEPA's Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III, Stationary Source Specific Methods, 40 CFR 60, Appendix A. The general procedures that will be followed for this measurements evaluation include:

- RM 1 – Sample Velocity Traverse for Stationary Sources;
- RM 2 – Determination of Stack Gas Velocity and Volumetric Flow Rate (Type-S Pitot Tube);
- RM 3A – Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure);
- RM 4 – Determination of Moisture Content In Stack Gases;
- RM 5 – Determination of Particulate Matter Emissions from Stationary Sources;
- RM 6C – Determination of Sulfur Dioxide Emissions from Stationary Sources (Instrumental Analyzer Procedure);
- RM 7E – Determination of Nitrogen Oxides Emissions from Stationary Sources (Instrumental Analyzer Procedure);
- RM 10 – Determination of Carbon Monoxide Emissions from Stationary Sources;
- RM 22 – Visual Determination of Fugitive Emissions from Material Sources and Smoke Emissions from Flares;
- RM 23 – Determination of Polychlorinated Dibenzo-p-dioxin and Polychlorinated Dibenzofuran Emissions from Municipal Waste Combustors;
- RM 26A – Determination of Hydrogen Halide and Halogen Emissions from Stationary Sources Isokinetic Method; and
- RM 29 – Determination of Metals Emissions from Stationary Sources.

4.1 Support Measurements for Stack Parameters

USEPA RMs 1 through 4 will be performed in support of the emissions measurements procedures selected for quantifying pollutant emission rates. RM 1, selection of sample points for velocity and particulate traverses, will be conducted prior to the initiation of any emission measurements at test location. The determination of stack gas flow rate, molecular weight, and moisture content (RMs 2 through 4) will be integrated into and performed concurrently with each RM 29 sample run.

4.1.1 Selection of Traverse Points by Reference Method 1

USEPA RM 1, "Sample Velocity Traverses for Stationary Sources," will be followed for the selection of measurement points at the test location. The physical characteristics of the test location meet the minimum criteria of RM 1 for isokinetic sampling. The calculated measurement points will be used for all isokinetic sample runs.

4.1.2 Flow Rate Determination by Reference Method 2

USEPA RM 2, "Determination of Stack Gas Velocity and Volumetric Flow Rate (Type-S Pitot Tube)," will be followed to measure the volumetric flow rate during each sample run at the sample location. This method will be incorporated into, and conducted concurrently with, each isokinetic sample run.

RM 2 allows for a stainless steel Type-S or standard pitot tube to be connected to a differential pressure gauge (inclined manometer). The measured pressure differential, observed at each traverse point, will be recorded on field data forms and used in determining the overall emission rate for each constituent.

In addition to velocity pressures, gas temperatures will be measured and recorded concurrently with all differential pressure data. The temperature will be measured with a Type K thermocouple located at the measurement tip of the pitot tube (in the same measurement plane). The Type K thermocouple will be connected directly to a calibrated digital temperature indicator for accurate measurements.

4.1.3 Molecular Weight Determination by Reference Method 3

USEPA RM 3A, "Determination of Oxygen and Carbon Dioxide Concentrations in Emissions from Stationary Sources (Instrumental Analyzer Procedure)," will be conducted concurrently with the pollutant measurements at the test location. Sample gas will be continuously extracted from the Unit 412 exhaust stack and directed to a combination O_2/CO_2 analyzer. Diluent O_2 and CO_2 data collected during the course of the sampling will be used to determine effluent gas dry molecular weight in accordance with USEPA RM 3A. If isokinetic sampling is conducted without continuous O_2 and CO_2 analysis, an integrated Tedlar bag sample will be collected and subjected to the combination O_2/CO_2 instrument for analysis. The results of the O_2 and CO_2 analysis will be used for the determination of effluent molecular weight.

USEPA RM 3A analyzer calibration requirements include; three point calibrations using USEPA Protocol 1 gas standards, and stringent instrument drift requirements. Calibrations will be completed at 80 to 100 percent of the full span value, 40 to 60 percent of the full span value, and 0 percent of the full span value (ultra-pure nitrogen for both analyzers).

The O_2/CO_2 analyzer will be subjected to a zero and two up-scale calibration gases prior to and upon completion of the RATA sample runs. The gas standards will be certified and traceable to USEPA Protocol 1 specifications, which require that the gas concentration be within ±1 percent of the documented value. The response of the analyzers compared to each certified calibration standard must be within ±2 percent of the high calibration gas standard (CS) value for each component as required by the method.

To calibrate the instruments, the gas standards will be introduced directly to the monitors at the sample inlet located on the back of each instrument. For the continuous measurements, the amount of bias of the O_2/CO_2 instrument will also be determined. This will be accomplished by introducing zero and one span gas to the instrument at the point at which the sample probe and heated sample filter are connected. The response of the analyzers to the direct zero and span gases (bias check) must be less than ±5 percent of the span value for each component as required by the method. The bias calibration check will be performed prior to and upon completion of each RATA sample run.

The magnitude of calibration drift will be calculated. Calibration drift is the difference in the initial (pre-test) bias calibration response and the final (post-test) bias calibration response for the same gas standard. The calibration drift must be within ±3 percent of the CS over each sample run for each O_2/CO_2 gas standard as required by RM 3A.

USEPA RM 3A, "Gas Analysis for the Determination Dry Molecular Weight," will be conducted for all mercury sample runs. Effluent sample gas will be extracted from each exhaust and collected in a clean dry tedlar bag. Each bag sample will be subjected to an Orsat or Fyrite for analyses of oxygen (O_2) and carbon dioxide (CO_2). Diluent O_2 and CO_2 analyses results will be used to calculate the effluent gas dry molecular weight.

4.1.4 Percent Moisture Determination by Reference Method 4

USEPA RM 4, "Determination of Moisture Content in Stack Gases," will be incorporated into each mercury sample run. The determination of moisture content will be accomplished by using a condenser and pump assembly, connected between a sample probe and metering system and performed concurrently with each RM 29 sample run.

Throughout each isokinetic sample run, a known volume of gas (measured by a dry gas meter) will be passed through the condenser assembly. Upon completion of each sample run, the total amount of condensate collected will be gravimetrically measured and the net gain calculated. The total moisture gain, volume of gas extracted, and measured meter temperature data will be used to calculate the actual moisture content of the effluent.

4.2 Particulate Determination by Reference Method 5

USEPA RM 5, "Determination of Particulate Matter Emissions from Stationary Sources" will be followed to determine particulate emission rates. Each RM 5 will be conducted in accordance with all applicable USEPA quality assurance requirements

Samples will be withdrawn isokinetically (100 percent ± 10 percent) from the source using a modular isokinetic sampling system. The sampling train will consist of a stainless steel nozzle, heated stainless steel probe with an S-Type pitot tube attached, a heated filter, four chilled impingers, and a metering console. The particulate sample will be collected on a quartz fiber filter supported by a Teflon frit and maintained at a temperature of 248 ± 25°F. The impinger train will be consistent with RM 5.

The system vacuum will extract the effluent gas through the interconnected, leak-free components. The entire system will be "leak checked" before and after each individual sample run to ensure sample integrity following RM 5 procedures.

A "K-factor" (coefficient) will be determined prior to the initiation of each sample run. This coefficient will be based upon preliminary measurements of gas temperature, flow rate, pressure, and moisture content. Multiplying the K-factor by the measured differential pressure will determine the isokinetic sample rate for each sample point. If a variable changes during a sample run, the coefficient will be adjusted to maintain isokinetic sampling rates. At isokinetic conditions, the velocity of the stack gas entering the nozzle of the extraction system will be equal to the effluent velocity at the sample point.

The quartz filter will be removed from the filter holder and placed in a Petri dish and sealed. The impingers will be recovered following RM 5 procedures. The RM 5 sample recovery will be conducted in accordance with all applicable USEPA quality assurance requirements.

4.3 Sulfur Dioxide Determination by Reference Method 6C

Sulfur dioxide emissions will be quantified at the Unit 412 exhaust stack according to USEPA RM 6C, "Determination of Sulfur Dioxide Emissions from Stationary Sources (Instrumental Analyzer Procedure)." This method allows for the determination of SO_2 concentrations by continuously extracting stack effluent and directing a portion of the sample to an SO_2 analyzer. An AMETEK Model 921M UV photometric SO_2 monitor will be used to measure the concentration (parts per million [ppm] by volume) of the effluent at the test location on a dry basis.

RM 6C provides rigorous analyzer calibration requirements, including three point calibrations using USEPA Protocol 1 gas standards, and stringent instrument drift requirements. Calibrations will be performed at 80 to 100 percent of the span value, 40 to 60 percent of the span value, and 0 percent of the span value (ultra-pure nitrogen).

The SO_2 analyzer will be subjected to the zero and two up-scale calibration gases prior to and upon completion of the test series. The gas standards will be certified and traceable to USEPA Protocol 1 specifications, which require that the gas concentration be within ±1 percent of the documented value. The response of the analyzer compared to each certified calibration standard must be within ±2 percent of the CS value for each component. To calibrate the instrument, the gas standards will be introduced to the inlet of the SO_2 RM analyzer before and upon completion of each test series. The amount of bias of the SO_2 RM system also will be determined before and after each sample run. This will be accomplished by delivering zero and one span gas directly to the point where the sample probe and heated sample filter are connected. The response of the analyzer to the bias checks must be less than ±5 percent of the span value for each check.

The magnitude of calibration drift also will be calculated. Calibration drift is the difference in the initial bias calibration response check and the final bias calibration response check for the same gas standard. The calibration drift must be within ±3 percent of the span for each sample run.

4.4 Nitrogen Oxides Determination by Reference Method 7E

USEPA RM 7E, “Determination of Nitrogen Oxides Emissions from Stationary Sources (Instrumental Analyzer Procedure),” will be used to accomplish the Unit 412 NO_X measurements. This method allows for the determination of NO_X concentrations by continuously extracting effluent from the stack and directing a portion of the sample to a NO_X analyzer. A TEI Model 42C Chemiluminescent NO_X analyzer will be used to measure the concentration (ppm by volume) of the effluent at the stack on a dry basis.

USEPA RM 7E provides rigorous analyzer calibration requirements, including three point calibrations using EPA Protocol 1 gas standards, and stringent instrument drift requirements. Calibrations will be completed at 80 to 100 percent of the span value, 40 to 60 percent of the span value, and zero percent of the span value (ultra-pure nitrogen).

The NO_X analyzer will be subjected to a zero and two up-scale calibration gases prior to the performance of the sample runs. The gas standards will be certified and traceable to USEPA Protocol 1 specifications, which require that the gas concentration is within ±1 percent of the documented value. The response of the analyzer compared to each certified calibration standard must be within ±2 percent of the CS for each component.

To calibrate the instrument, the gas standards will be introduced directly to the NO_X monitor at the sample inlet located on the back of the instrument. The amount of bias of the NO_X CEM system also will be determined. This will be accomplished by introducing zero and one span gas to the NO_X system at the point in which the sample probe and heated sample filter are connected. The response of the analyzer system to the zero and span gas (bias check) must be less than ±5 percent of the CS for each component. The bias calibration check will be performed prior to, and upon completion of, each sample run.

The magnitude of calibration drift will also be calculated. Calibration drift is the difference in the initial (pre test) bias calibration response and the final (post test) bias calibration response for the same gas standard. The calibration drift must be within ±3 percent of the CS each sample run for each gas standard.

4.5 Carbon Monoxide Determination by Reference Method 10

The CO measurements will be conducted according to USEPA RM 10, “Determination of Carbon Monoxide Emissions from Stationary Sources.” Sample gas will be continuously extracted from the test location and directed to a TEI Model 48C, Gas Filter Correlation (GFC), NDIR CO instrument for analysis. The GFC feature of the CO analyzer eliminates potential interference by substances, which absorb infrared energy.

USEPA RM 10 provides rigorous analyzer calibration requirements, including three point calibrations using EPA Protocol 1 gas standards, and stringent instrument drift requirements. Calibrations will be completed at 80 to 100 percent of the span value, 40 to 60 percent of the span value, and zero percent of the span value (ultra-pure nitrogen).

The CO analyzer will be subjected to a zero and two up-scale calibration gases prior to the performance of the sample runs. The gas standards will be certified and traceable to USEPA Protocol 1 specifications, which require that the gas concentration is within ±1 percent of the documented value. The response of the analyzer compared to each certified calibration standard must be within ±2 percent of the CS for each component.

To calibrate the instrument, the gas standards will be introduced directly to the CO monitor at the sample inlet located on the back of the instrument. The amount of bias of the CO CEM system also will be determined. This will be accomplished by introducing zero and one span gas to the CO system at the point in which the sample probe and heated sample filter are connected. The response of the analyzer system to the zero and span gas (bias check) must be less than ±5 percent of the CS for each component. The bias calibration check will be performed prior to, and upon completion of, each sample run.

The magnitude of calibration drift will also be calculated. Calibration drift is the difference in the initial (pre-test) bias calibration response and the final (post test) bias calibration response for the same gas standard. The calibration drift must be within ±3 percent of the CS each sample run for each gas standard.

4.6 Visible Emissions by Reference Method 22

This method will be followed to determine visible smoke emissions from the Unit 412 incinerator process. The method is used to determine the amount of time that visible emissions occur during the observation period (*i.e.* the accumulated emission time). This method does not require that the opacity of emissions be determined. Since this procedure requires only the determination of whether visible emissions occur, observer certification according to the procedures of RM 9 is not required. However, it is necessary that the observer is knowledgeable with respect to the general procedures for determining the presence of visible emissions. At a minimum, the observer will be trained and knowledgeable regarding the effects of background contrast, ambient lighting, observer position related to lighting, wind, and the presence of uncombined water (condensing water vapor) on the visibility of emissions.

4.7 Dioxins and Furans Determination by Reference Method 23

USEPA RM 23, “Determination of Polychlorinated Dibenzo-p-dioxin and Polychlorinated Dibenzofuran Emissions from Municipal Waste Combustors,” will be followed to determine D/F concentrations and emissions from the Unit 412 test location.

4.7.1 Sample Train Component Preparation

All glass parts of the sample train including the sorbent trap will be pre-cleaned prior to sampling according to the following procedures.

- Soak in hot soapy water (Alconox) at 50°C or higher;
- Rinse three times with tap water;
- Rinse three times with deionized water;
- Rinse three times with pesticide grade acetone;
- Rinse three times with pesticide grade methanol/methylene chloride;

- Bake at 450ºF for 2 hours; and
- Seal with clean Teflon tape.

The glassware will be sealed with Teflon tape followed by aluminum foil until sample train assembly. Following sample recovery, the glassware will be reused at the same sampling location as allowed by the method.

The XAD-2 resin traps will be pre-cleaned and prepared by Analytical Perspectives. Each sorbent trap will be charged with 20 to 30 grams of the precleaned resin and the five surrogate compounds listed in Table 2 of RM 23 will be added to the resin. Care will be taken to ensure that the resin is kept at temperatures below 120°F during shipment and before and after sample collection to prevent resin decomposition. The time between charging the trap and use in the field will be minimized and will not be allowed to exceed 14 days. The sorbent traps will be shipped from Analytical Perspectives to AECOM's Fort Collins facility under strict chain-of-custody (COC) documentation.

4.7.2 Sample Collection

Samples for D/F will be withdrawn isokinetically from the source using an RM 23 sampling train as depicted in **Figure 4-1**. The sampling train will consist of a Teflon coated stainless steel nozzle, a heated Teflon lined probe, a pretreated glass fiber filter maintained at a temperature of 248°F ± 25°F, a water-cooled condenser, a sorbent trap containing XAD-2 resin, five chilled impingers, and a metering console. The water-cooled condenser and sorbent trap will be arranged in a manner that allows the condensate to drain vertically through the trap. Gas entering the trap will be maintained at or below 68°F. The first impinger (optional knockout) will be empty, the second and third impingers each will contain 100 ml of HPLC water, the fourth will be empty, and the fifth will contain pre-weighed silica gel. Sealing greases will not used on any portion of the sample train.

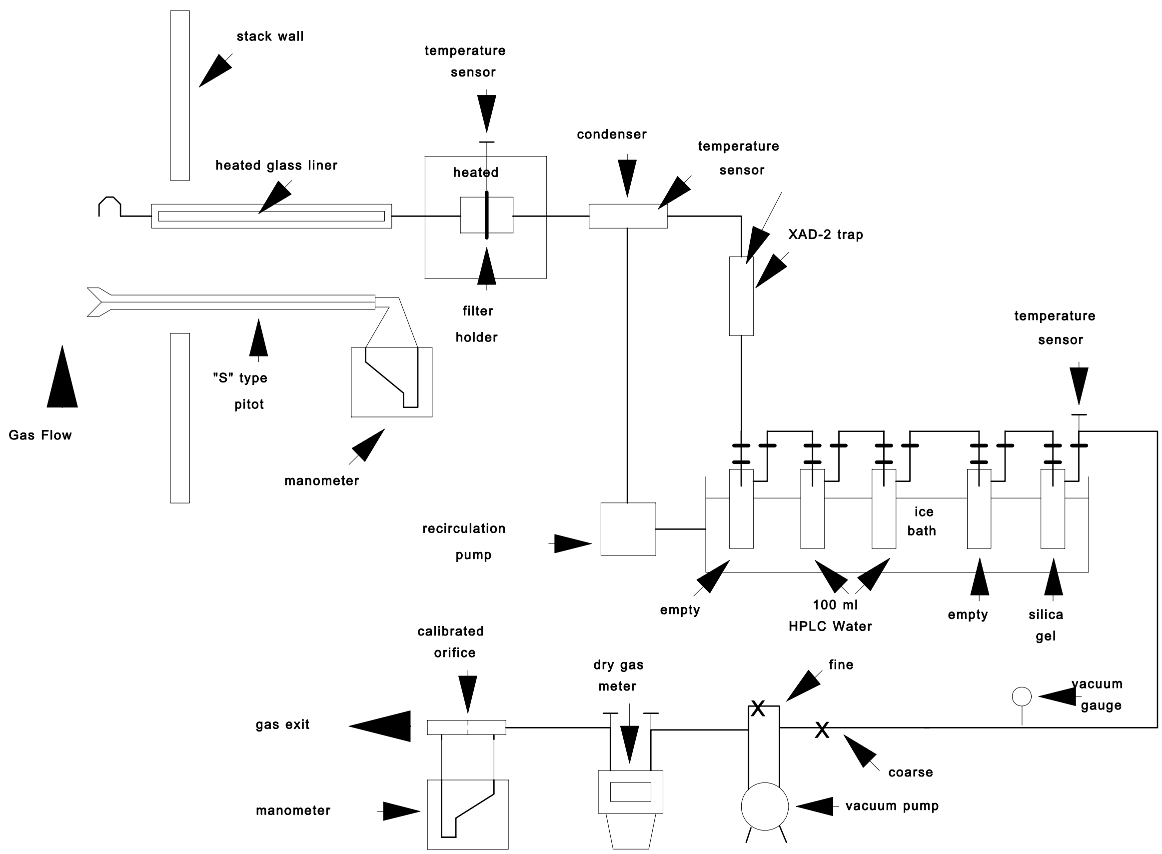

Figure 4-1 Reference Method 23 Sampling Train

4.7.3 Sample Recovery

Recovery of the samples and assembly of the sample trains for reuse will be conducted in a dust-free environment. Each impinger and the XAD-2 trap will be weighed prior to and at the conclusion of each sample run. The volume of water vapor condensed in the impingers, XAD resin and silica gel will be summed and entered into moisture content calculations.

All sample-exposed components of the sampling train will be rinsed with acetone and methylene chloride (rinses recovered per RM 23), and finally acetone (toluene rinse discarded per RM 23). Sample containers from a typical run include the following.

- Container 1 – Filter(s);
- Container 2 – Rinses of nozzle, probe, and front-half of filter holder and rinses of back-half of filter holder and condenser;
- Container 3 – XAD cartridge and resin;
- Container 4 – Impinger contents; and
- Container 5 – Silica gel.

The samples, comprised of containers 1 through 3, will be shipped to Analytical Perspectives, Inc. under strict COC documentation. Appropriate shipping containers will be used to keep the samples cool during shipping.

4.7.4 Sample Analysis

The RM 23A samples will be analyzed by Analytical Perspectives, Inc. in strict accordance with Analytical Perspective's QA Program. The filter(s), XAD-2 resin, toluene and methylene chloride rinses will be analyzed for tetra-octa (4-8) D/F according to USEPA RM 0023A with high-resolution gas chromatography/high resolution mass spectrometry. All extracts from one run will be analyzed in separate front half and back half sample fractions.

4.7.5 Data Reduction

The D/F results will be expressed in terms of toxicity equivalents (TEQ), as specified in 40 CFR §63.1342. The D/F congeners (tetra, hepta, hexa and octa) will be converted to TEQ using toxicity equivalence factors (TEFs), as the summation of the TEFs of the congeners, multiplied by their relative concentrations.

Any D/F congeners that are reported by Analytical Perspectives, Inc. as nondetected (below the method detection limit ND) shall be counted as zero for purposed of calculating the total D/F TEQ concentration for that sample, as specified in RM 0023A (§7.4).

4.8 Hydrogen Chloride Determination by Reference Method 26A

USEPA RM 26A, "Determination of Hydrogen Halide and Halogen Emissions from Stationary Sources Isokinetic Method," will be followed for the determination of HCl emissions at the Unite 412 test location. This method will be performed in conjunction with the particulate measurement procedures as allowed by the methods. Included in the RM 26A sampling system will be a calibrated glass or Teflon coated nozzle, stainless steel probe, glass or Teflon probe liner, insulated filter oven, glass filter holder and tared quartz-fiber filter, condenser assembly, and calibrated extraction system. The system vacuum will extract the effluent sample gas through the interconnected, leak-free components. The entire system will be "leak checked" before and after each individual sample run to ensure sample integrity.

A "K-factor" (coefficient) will be determined prior to the initiation of each RM 26A sample run. This coefficient will be based upon preliminary measurements of gas temperature, flow rate, pressure, and moisture content. Multiplying the K-factor by the measured differential pressure at each sample point will provide for isokinetic sample rates for each sample point. If a variable changes during a sample run, the coefficient will be adjusted to maintain isokinetic sample rates. At isokinetic conditions, the velocity of the stack gas entering the nozzle of the extraction system will be equal to the effluent velocity at the sample point.

The condenser assembly will consist of a series of five glass impingers with glass inserts interconnected to each other by glass U-tubes, providing a "leak tight" seal with 28/15 ball and socket connections. The first and second impingers will contain sulfuric acid (H_2SO_4). The third and fourth impingers will contain sodium hydroxide (NaOH). The fifth impinger will be filled with a pre-weighed amount of silica gel to capture any residual moisture from the sample stream. The impinger train will be set in an ice bath to maintain the extracted gas outlet temperature at or below 70°F. By cooling the sample, all water vapor and gases will be condensed and collected.

Three valid sample runs will be performed at the test location. Upon completion of each sample run, the probe will be removed from the effluent and allowed to cool. A leak check of the sampling system will then be performed to verify the integrity of the system. The leak rate must not exceed 0.02 actual cubic feet per minute (acfm) in order for the test to be considered valid.

Each sample train will be carefully recovered. The H_2SO_4 solution in the first two impingers will be quantitatively recovered in a glass sample container. The impingers and connecting glassware will then be rinsed with water and added to the same sample jar. The contents of the third and fourth impingers will be placed in a glass sample jar. The silica gel from the fifth impinger will be weighed to determine the moisture gain.

Portions of the H_2SO_4 and NaOH absorbing reagents will be collected for blanks and diluted to the approximate volume of the corresponding sample jars with rinse water from the same wash bottle used. All liquid levels will be marked. The H_2SO_4 and NaOH sample jars and reagent blanks will be sent to TestAmerica located in West Sacramento, California for HCl and Cl_2 analysis by IC.

4.9 Metals Determination by Reference Method 29

USEPA RM 29, “Determination of Metals Emissions from Stationary Sources,” will be followed to determine the metals (Cd, Pb, Hg) emission rates exhausted by Unit 412. Included in the RM 29 sampling system will be a calibrated glass or Teflon coated stainless steel nozzle, stainless steel probe, glass or Teflon probe liner, insulated filter oven, glass filter holder and tared quartz-fiber filter, condenser assembly, and calibrated extraction system. The system vacuum will be used to extract the effluent gas through the interconnected, leak-free components. The entire system will be “leak checked” before and after each individual sample run to ensure sample integrity.

A “K-factor” (coefficient) will be determined prior to the initiation of each mercury sample run. This coefficient will be based upon preliminary measurements of gas temperature, flow rate, pressure, and moisture content. Multiplying the K-factor by the measured differential pressure will determine the isokinetic sample rate for each sample point. If a variable changes during a sample run, the coefficient will be adjusted to maintain isokinetic sampling rates. At isokinetic conditions, the velocity of the stack gas entering the nozzle of the extraction system will be equal to the effluent velocity at the sample point.

4.9.1 Sampling by Reference Method 29

By this method, mercury emissions will be withdrawn isokinetically from the selected sources, collected on a heated filter (maintained at a controlled temperature of 248 ± 25°F), and passed through a series of chilled impingers containing solutions of nitric acid/hydrogen peroxide (HNO_3/H_2O_2) and potassium permanganate ($KMnO_4$) as shown in **Figure 4-2**.

The sample components will be recovered in separate front-half (probe wash and filter) and back-half (impinger solutions) fractions. The front-half and back-half components will be rinsed with 0.1 normal (N) nitric acid (HNO_3) to capture all particulate and collected in their respective containers. The probe wash, digested filter, and aliquots of impinger solutions will be analyzed for mercury by inductively coupled plasma-mass spectroscopy (ICPMS) analysis or cold vapor atomic absorption (CVAA) analysis.

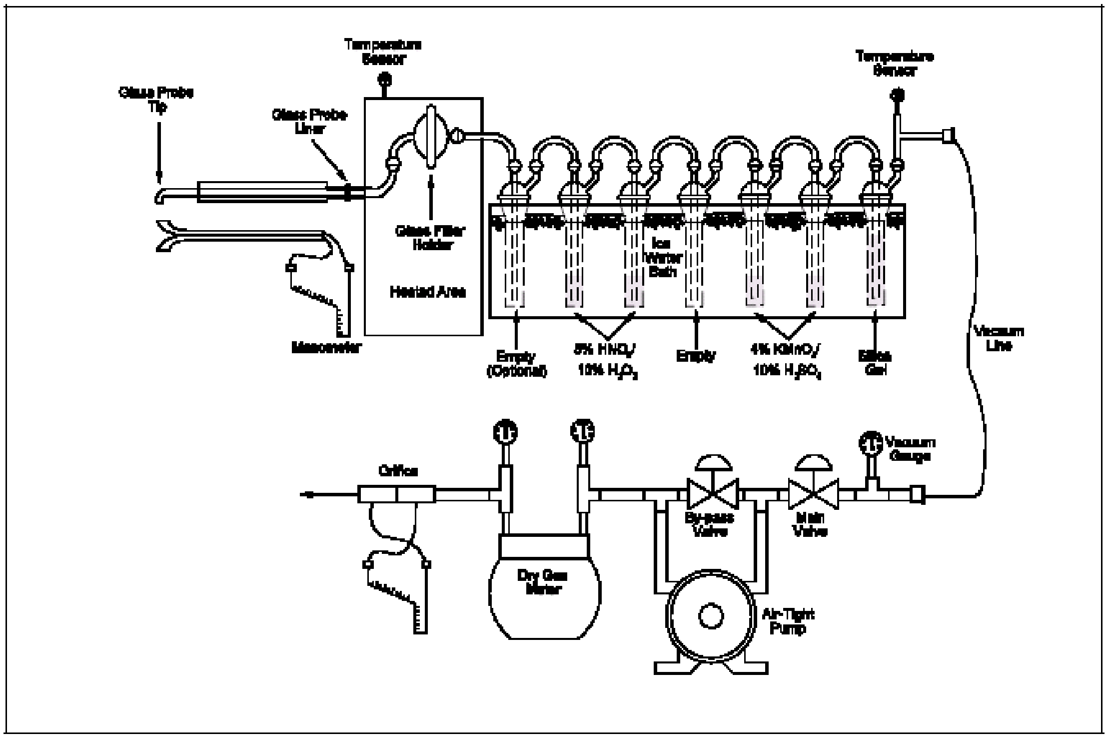

Figure 4-2 Reference Method 29 Sampling Train

The condenser assembly will consist of a series of six glass impingers with glass inserts interconnected to each other by glass U tubes, providing a “leak tight” seal with 28/15 ball and socket connections. The first and second impingers will contain HNO_3/H_2O_2. The third impinger will be left empty. The fourth and fifth impingers will contain $KMnO_4$.The sixth impinger will be filled with a pre weighed amount of silica gel to capture any residual moisture from the sample stream. The impinger train will be set in an ice bath to maintain the extracted gas outlet temperature at or below 70°F. By cooling the sample, all water vapor and gases will be condensed and collected. **Table 4-1** describes the condensate (impinger) train configuration for RM 29 testing including the $KMnO_4$ impingers which are exclusive to mercury capture and analysis.

Table 4-1 Reference Method 29 Condensate (Impinger) Train

Impinger No.	Contents	Configuration
1	100 ml HNO_3/H_2O_2	Straight
2	100 ml HNO_3/H_2O_2	Greenburg-Smith
3	Empty	Straight
4	100 ml $KMnO_4$ (Optional)	Straight
5	100 ml $KMnO_4$ (Optional)	Straight
6	200 - 300 g Silica Gel	Straight

Prior to sampling, the impingers and their contents will be weighed and the initial weights recorded. Upon completion of sampling, the impingers will be removed from the ice bath and the moisture gain will be determined gravimetrically by subtracting the final weight from the initial weight for each impinger.

Three valid sample runs will be performed for each of the processes being tested. Upon completion of each sample run, the probe will be removed from the exhaust stack and allowed to cool. A leak check of the sampling system will then be performed to verify the integrity of the system. The leak rate must not exceed 0.02 acfm, in order for the test to be considered valid.

Each sample train will be carefully recovered. The filter will be removed from its sample holder with Teflon-coated or non-metallic tweezers and placed in a labeled petri dish. The nozzle, probe, and front-half of the filter holder will be first rinsed with 0.1N HNO_3 to collect any mercury that adhered to the front-half components. The rinse will be quantitatively recovered in a glass sample container. The contents of the first three impingers will be placed in a glass sample jar; the impingers and filter back-half will then rinsed with 100 ml of 0.1N HNO_3 and added to the same sample jar. The contents of the fourth and fifth impingers will be placed in a glass sample jar; these impingers will then rinsed with 100 ml of $KMnO_4$ and added to the same sample jar. The silica gel from the sixth impinger will be weighed to determine moisture gain.

4.9.2 Analyses by Reference Method 29

Each recovered sample will be composed of four fractions: a filter, HNO_3 front-half wash, HNO_3/H_2O_2 impinger contents with rinse, and $KMnO_4$ impinger contents and rinse. The filter will be digested and added to the probe wash for mercury analysis. Proportional aliquots of the probe rinse (front-half of the sample train) and samples recovered from impingers 1 through 3 and rinses (back-half of the sample train) will be combined and analyzed for mercury by cold vapor atomic adsorption (CVAA).

4.10 Calculations and Nomenclature

The following section presents the calculations for determining flow rate, molecular weight, and moisture content. In addition, calculations for the determination of particulate concentration and particulate emission rate are provided below. The nomenclature for each calculation also is defined.

Calculations

Stack Pressure (in Hg):

$$P_s = P_b + \frac{P_g}{13.6}$$

Volume of Water Collected (scf):

$$V_{wc(std)} = 0.04707 \times MG$$

Gas Meter Volume at Standard Conditions (dscf):

$$V_{m(std)} = V_m \times Y_d \times \left(\frac{T_{std}}{P_{std}} \right) \times \left(\frac{P_b + \frac{\Delta H_{avg}}{13.6}}{T_{m(avg)}} \right)$$

Fractional Moisture Content (dimensionless):

$$B_{ws} = \frac{V_{wc(std)}}{V_{wc(std)} + V_{m(std)}}$$

Moisture Content (%):

$$H_2O\% = B_{ws} \times 100$$

Molecular Weight (dry, lb/lb-mole):

$$M_d = (0.44 \times \%CO_2 + (0.32 \times \%O_2) + (0.28 \times (100 - \%CO_2 - \%O_2))$$

Molecular Weight (wet, lb/lb-mole):

$$M_s = M_d \times (1 - B_{ws}) + (18 \times B_{ws})$$

Velocity (feet per second):

$$v_s = 85.49 \; x \; C_p \; x \; \sqrt{\Delta p} \;\; x \; \sqrt{\frac{T_s}{P_s \; x \; M_w}}$$

Flow Rate (actual cubic feet per minute):

$$Q_a = V_s \times A_s \times 60$$

Flow Rate (dry standard cubic feet per minute):

$$Q_s = Q_a \times (1 - B_{ws}) \times 17.64 \times \left(\frac{P_s}{T_s}\right)$$

Percent Isokinetic (%):

$$\% I = \frac{0.09450 \; x \; T_s \; x \; V_{m(std)}}{P_s \; x \; v_s \; x \; A_n \; x \; \Theta \; x \; (1 - B_{ws})}$$

Particulate Concentration (lb/dscf):

$$C_{particulate} = \frac{MG_{particulate}}{453.5924 \; x \; V_{m(std)}}$$

Particulate Emission Rate (lb/hr):

$$E_p = C_{particulate} \; x \; dscfm \; x \; 60$$

Gaseous Pollutant Concentration (dry, ppm):

$$C_{gas} = (C^{/} - C_o) \times \left(\frac{C_{ma}}{C_m - C_o} \right)$$

Gaseous Pollutant Emission Rate (lb/hr):

$$E_{gas} = \frac{C_{gas} \; x \; MW \; x \; Q_s \; x \; 60}{385 \; x \; 1{,}000{,}000}$$

Emissions of D/F (ng TEQ/dscm):

$$C_{(D/F)T} = \frac{\sum_{i=1}^{n} C_{(D/F)_i} TEF_i}{V_{m(std)}} \; \frac{ng}{1{,}000\,pg} \; \frac{(20.9 - 7)}{(20.9 - \%O_2)}$$

<u>Nomenclature</u>

A_n	Cross-Sectional Area of the Nozzle (square feet)
A_s	Cross-Sectional Area of the Stack (square feet)
B_{ws}	Water Vapor in Gas Stream (proportional by volume)
C’	Average Gas Concentration Indicated by Analyzer, dry basis (ppm)
CC	Confidence Coefficient (one tailed, 2.5% error)
C_{gas}	Corrected Effluent Gas Concentration, dry basis (ppm)
C_m	Average of Initial and Final System Calibration Bias Check Responses for the Upscale Calibration Gas (ppm)
C_{ma}	Actual Concentration of Upscale Calibration Gas (ppm)
C_o	Average of Initial and Final System Calibration Bias Check Responses for the Zero Gas (ppm)
C_p	Pitot Tube Coefficient, Dimensionless (0.84 for Type-S)
$C_{particulate}$	Particulate Concentration (lb//dscf)
$C_{(D/F)I}$	Concentration of D/F congener i in sample (pg/liter)
$C_{(D/F)T}$	Total concentration of D/F congeners in sample (ng/liter)
D/F	Stack concentration of polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans (ng TEQ/dscm)
Δ P	Average Velocity Head of Gas (in WC)
E_p	Particulate Emission Rate (lb/hr)
$H_2O\%$	Moisture Content of Gas Stream (%)
M_d	Molecular Weight of Stack Gas, dry basis (lb/lb-mole)
M_s	Molecular Weight of Stack Gas, wet basis (lb/lb-mole)
$MG_{particulate}$	Particulate mass gain (mg)

MW	Molecular Weight of Pollutant (SO_2 = 64, NO_X = 46, CO = 28)
ng	nanograms (10^{-9} grams)
pg	picograms (10^{-12} grams)
P_b	Uncorrected Barometric Pressure (in Hg)
P_g	Static Pressure of Stack Gas (in WC)
P_s	Absolute Pressure of Stack Gas (in Hg)
P_{std}	Standard Absolute Pressure (29.92 in. Hg)
$\%CO_2$	Percent Carbon Dioxide, Dry Basis
$\%O_2$	Percent Oxygen, Dry Basis
%I	Isokinetic sample rate (%)
Q_a	Actual Flow Rate (acfm)
Q_s	Dry Standard Flow Rate (dscfm)
RM	Reference Method (RM 6C, RM 7E or RM 10) Data Average (arithmetic mean)
$T_{m(avg)}$	Average DGM Absolute Temperature (°R)
T_s	Average Stack Gas Temperature (°R)
V_s	Average Gas Velocity (feet per minute)
T_{std}	Standard Absolute Temperature (528 °R)
V_m	Dry Gas Volume as Measured by the DGM (dcf)
$V_{m(std)}$	Dry Gas Volume Corrected to Standard Conditions (dscf)
$V_{wc(std)}$	Volume of H_2O Collected in Impingers and Silica Gel Corrected to Standard Conditions (ml)
Y_d	DGM Calibration Factor
Θ	Sample Time (minutes)

5.0 Quality Assurance/Quality Control

5.1 Objectives

The objectives of AECOM's QA/QC program are as follows:

- To continually monitor the precision and accuracy of the data being generated for all source emission measurements.
- To implement measures designed to control the precision and accuracy of all data generated for individual sources.
- To maintain permanent records of analytical QC data and equipment calibrations that include traceability and certification.
- To identify, document, and maintain a COC log, which accounts for each method sample collected during each measurement program.

5.2 Field Program

All primary, USEPA-approved testing procedures selected for this test program are referenced in the 40 CFR 60, Appendix A. No deviations from these procedures are expected to be necessary. All field personnel responsible for this emission test program will follow the procedures dictated by the applicable test methods.

All field test personnel involved with this test program will be experienced and trained in field sampling methods and procedures. Each field personnel will be assigned key responsibilities in phases of sample collection, sample recovery, COC, and transportation of samples. Basic responsibilities for field personnel include, but are not limited to:

Record keeping. Field Personnel will record all pertinent test parameters and relevant observations on the appropriate field data forms.

Safety requirements. Field personnel will be familiar with all company safety regulations and will be provided with all the necessary safety equipment.

Sample handling. Field personnel will be trained in the proper procedures for handling samples including: use of sample containers, sample preservation, identification, storage of collected samples, and COC.

Instrumentation. Specific field personnel will be trained in the proper operation, calibration, trouble shooting, and maintenance of the instrumentation intended for this program. This includes the use of pumps, control console(s), samplers, and instrumentation.

Quality control (QC). Field personnel will be trained in all aspects of QC that relate directly to the specific reference method test procedures, sample handling, analyses, and reporting.

Mr. John Rosburg, of AECOM, will be the designated field manager and will be responsible for coordinating testing activities with Pogo and ADEC. He will provide answers to questions concerning test methodology, QC, and all other project aspects. The field manager also will be responsible for delegating work assignments to the members of the test crew, making sure all QA/QC procedures are carried out, and documenting all field activities in a bound log book.

All field instrumentation will be maintained and calibrated according to all applicable USEPA guidelines. Records of instrument maintenance and calibration are kept in historical files and continually updated. Calibrations of all field instrumentation, at a minimum, meet or exceed the mandated procedures stipulated in the Quality Assurance Handbook for Air Pollution Measurement Systems, Volume III. All documentation of calibrations is maintained on file at all times. Calibration documentation for the equipment used in this test program will be provided in the Appendices of the test report.

5.3 Sample Documentation

All field data collected for each selected reference method test procedure will be documented on field data forms. Each form, specific to each particular sample run, will include information as to the source tested, date and time of sample collection, analyst(s) performing the test, and all data necessary for test validation. Each field data sheet will be completed by the responsible technician at the time of the test and checked by the Field Manager for accuracy and completeness after each test series. Copies of all raw field data sheets will be included in the appendices of the test report, with the originals maintained in project files at AECOM's Fort Collins office.

Sample containers utilized for the collection and storage of samples will be specific to each test procedure. Filter substrates will be maintained in individually labeled polyethylene Petri dishes sufficient in size to receive the samples unaltered and with the exposed surface protected from sample loss.

Collection of all blanks will be specific to each test performed. The field blanks will be collected at the test location and subjected to the same ambient conditions as the samples. This type of blank will be collected for each reagent used in each test series and analyzed in the same manner as the sample itself.

Each recovered sample will be labeled with standard sample tags and uniquely identified. The tags will provide information regarding the unit tested, sample location, date and time of collection, reagent(s) used, and the test number. The sample container will be sealed, liquid level marked (if applicable), and properly stored until it is transported to the laboratory.

Standard COC forms will be completed before any samples are transported to the laboratory. This procedure is dictated by the USEPA and strictly adhered to by AECOM. Each sample will be tagged with a COC tag, which requires the same information as the field sample label.

5.4 Analytical Quality Control

All analytical procedures used for this program are approved by the USEPA and referenced in 40 CFR 60 (where applicable). All particulate gravimetric analysis will be performed by AECOM at the Fort Collins Air Resources Laboratory. AECOM's QA/QC program meets or exceeds USEPA standards. The D/F XAD-2 resin traps and filters will be prepared by Analytical Perspectives of Wilmington, North Carolina who also will perform the sample analysis. The metals (Cd, Pb, Hg) and HCl analysis will be performed by TestAmerica located in West Sacramento, California.

5.5 Data Reduction, Validation, and Reporting

AECOM has implemented specific measures to ensure that reliable data is generated as a result of the sampling and analytical activities of every field program. The objective of this phase of AECOM's QA/QC program is to follow the proper collection of representative and QA field and analytical data with approved data reduction methods and equations.

All calculations are performed using QA spreadsheets incorporating standard accepted equations, as required by the applicable pollutant specific sampling methodology. Data reduction will be performed by qualified engineers or data analysts familiar with standard engineering practices and approved methods. Calculation methods and equations, including conversion factors and units, will be defined in this test report to allow the reviewer to easily reproduce the final results from the raw field data and process information provided in the appendices of the report. The final report will include all raw data, QA/QC documentation, and process data collected during the test program. The initial draft of the test report, including both narrative and calculations, will be subjected to review by the project manager and/or Principal-in-Charge, prior to final publication.

Appendix A

Field Data Forms

Appendix B

Methodology